SEMESTER STUDY PLAN
CAPITA SELECTA ON ALGEBRA II
(ELECTIVE COURSE)
(Project Based Learning Method)

DEPARTMENT OF MATHEMATICS AND DATA SCIENCE

FACULTY OF MATHEMATICS AND NATURAL SCIENCES

UNIVERSITAS ANDALAS

2024

SEMESTER STUDY PLAN (SSP)
BACHELOR PROGRAM OF MATHEMATICS
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS ANDALAS

Course Name	Course Code	URL *I-Learn*	Credits	Semester	Compilation Date
Capita Selecta on Algebra 2	MAT61214	https://sci.ilearn.unand.ac.id	3	4	14 May 2024

Person In Charge	Study Plan Creator	Head of Research Group	Head of Study Program
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	Intended Learning Outcomes	
Intended Learning Outcomes (ILO) and Performance Indicator (PI)	ILO-3	An ability to identify, explain and generalize simple mathematical problems PI-1: An ability to identify simple mathematical problems PI-2: An ability to explain simple mathematical problems
	ILO-4	An ability to use concept and fundamental technique of mathematics in solving simple mathematical problems PI-1: An ability to choose appropriate basic mathematical concepts and techniques in solving simple mathematical problems
	ILO-5	An ability to formally and correctly proves a simple mathematical statements using facts and methods that have been studied. PI-1: An ability to identify formal structures and analogous forms in mathematics
	ILO-6	Have ability data literacy and technology and can apply them in solving simple mathematical problems or other relevant fields PI-1: An ability to identify the right data and technology to solve simple mathematical problems or other fields
	ILO-7	An ability to communicate effectively especially in the area of mathematics in with diverse communities PI-1: An ability to convey ideas or study results orally, especially in the field of mathematics

			PI-2: An ability to present ideas or study results in writing, especially in the field of mathematics
			PI-3: An ability to respond to feedback given
	ILO-8		An ability to work in a team
			PI-1: An ability to actively participate in a team with full responsibility
			PI-2: An ability to respond well to any feedback within the team
			PI-3: An ability to complete tasks according to the set schedule
			PI-4: An ability to adapt in a team

Course Learning Outcomes

	1	Students are able to explain matrices, modules, and systems of linear equations over algebra max-plus (ILO-5 : PI-1)
	2	Students are able to determining the eigenvalues and vectors of a matrix over a max plus algebra (ILO-5 : PI-1)
	3	Students are able to identify real problems related to vector spaces, inner product spaces, values and eigenvectors, and linear transformations (ILO-3: PI-1, PI-2);
	4	Students are able to choose methods, data, data collection techniques, and basic techniques to solve problems related to vector spaces, inner product spaces, values and eigenvectors, and linear transformations (ILO-6: PI-1)
	5	Students are able to use the concepts of vector space, inner product space, value and eigenvector, and linear transformation to solve real problems (ILO-4: PI-1);
	6	Students are able to analyze and evaluate research results (ILO-6: PI-1)
	7	Students are able to communicate the results of their research orally and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3);
	8	Students are able to work in teams (ILO-8)

Brief Description	This course will provide and discuss some basic and important concepts in max-plus algebra theory or tropical linear algebra. Max-plus algebra or tropical linear algebra is the study of the set of real numbers that expanded i.e. $R_{max} = R \cup \{\infty\}$ with two operations defined with $a \oplus b = max\{a, b\}$ and $a \otimes b = a + b$. As for subjects studied include Max-Plus Algebra: definitions and properties. Then introduced the maxplus algebraic upper matrix and the Max-Plus Algebra top semimodule. Furthermore, given the theory of the Max Plus Algebraic set related to solving System of Linear Equations over Max-Plus Algebra, the relation of Matrix Algebra over max-plus algebra with graph theory, and values and eigenvector max-plus. Next, students dissected several articles related to the application of max-plus algebra in network analysis, scheduling and queue analysis.
Course Materials	1. Max-Plus Algebra as Semiring, Semi Module 2. Max-Plus Linear Equation System 3. Eigen Max-Plus Values and Vectors 4. Application of Max-Plus Systems of Linear Equations, Matrix Algebra and Graph Theory and Max-Plus Eigenvalues and Vectors on scheduling issues,/queue/transportation
References	**Main:** 1. Heidergott, B., Older, J. G and Woude, J. 2005. Max Plus at Work. Princeton University press. **Additional:** 2. Butkovic, Peter. 2010. Max Linear System : Theory and Algorithm. Springer. New York 3. Related articles or publications
Learning Media	**Software:** ● LMS Unand (http://fmipa.ilearn.unand.ac.id/) ● Zoom meeting ● Whatsapp	**Hardware:** ● Computer/Laptop ● Smartphone
Team Teaching	1. Monika Rianti Helmi, M.Si
Assessment	Proposal, Project and Presentations
Required courses	Elementary Linear Algebra, Algebras Structure, Graph Theory
Academics Norms	https://akademik.unand.ac.id/images/2022-03-30%20Peraturan%20Rektor%20Nomor%207%20Tahun%202022%20Penyelenggaraan%20Pendidikan-khusus%20Bab%20II.pdf

Weekly Study Plan

Week	Course Outcomes (2)	Indicator (3)	Assessment (4)	Activities/Forms of Learning [Time estimated]				Media (9)	Subject, references (10)	Weight (11)
				Synchronous*		Asynchronous**				
				Face to face Offline (5)	Face to face Online (6)	Individual (7)	Collaboration (8)			
1-3	CLO-1 Students are able to explain matrices, modules, and systems of linear equations over algebra max-plus (ILO-5 : PI-1)	• Accuracy in showing a max-plus algebra as a module Accuracy in operating max-plus operations. • Accuracy in writing systems of linear equations over max plus algebra • Accuracy in determining the solution of linear equations over max-plus algebra	Mid-Test Test 10%	Teaching and discussion: • Explanation of study plan and explanation of tasks • Explanation a max-plus algebra as a module • Explanation systems of linear equations over max plus algebra • Explanation the solution	Teaching and discussion: - Explanation of Semester Learning Plan - explanation of learning material - explanation of the task - explanation of the assessment [3 × 3 × 50 minutes]	Students read and study learning materials Students do assignments independently to solve Linear equation System of linear equation over max-plus algebra [3×3×120 minutes]		● PPT ● I learn (LMS Unand) (Specific condition: Zoom meeting, WA group, learning video)	● Tuition Contract ● SSP ●Max-plus algebra as a semi ring and a module ●Matrix over max-plus algebra ●System of linear equation over max-plus algebra [1] Chapter 1,	10%

				of linear equations over max-plus algebra • [3 × 3 × 50 minutes]	(Specific conditions: The total number of blended learning meetings is 40% of the total number of meetings)				[2] Chapter 1	
4-5	CLO-2 Students are able to determining the eigen values and vectors of a matrix over a max plus algebra (ILO-5 : PI-1)	• Accuracy in determining eigen values of a matrix over max-plus algebra • Accuracy in determining eigen vector over max plus algebra	Mid-Term Test 10%	Teaching and discussion: - explanation of learning material - explanation of the task - explanation of the assessment [2 × 2 × 50 minutes]	Teaching and discussion: - Explanation of Semester Learning Plan - explanation of learning material - explanation of the task - explanation of the assessment [2 × 3 × 50 minutes] (Specific conditions: The total number of blended	Students read and study learning materials Students do assignments independently to determine eigen values and eigen vector of a matrix over max-plus algebra [2×3×120 minutes]		● PPT ● I learn (LMS Unand) ● (Specific condition: Zoom meeting, WA group, learning video)	● Tuition Contract ● SSP ● Eigen value of matrix over max-plus algebra [1] and [2] Chapter 1	10%

					learning meetings is 40% of the total number of meetings)					
6-7	CLO-3 Students are able to identify real problems related to vector spaces, inner product spaces, values and eigenvectors, and linear transformations (ILO-3: PI-1, PI-2);	● Accuracy in identifying problems related to the Application of Max-Plus algebra on scheduling issues/queue/ transportation ● Accuracy in formulating problems related to the Application of Max-Plus algebra on scheduling issues/queue/ transportation	Research Proposal progress and report 10%	Teaching and discussion: Explanation of study plan and explanation of tasks Review and discussion of identification of problems and constraints of design project tasks [2 × 3 × 50 minutes]		Students identify problems and seek information on observations of the surrounding environment related to the Application of Max-Plus algebra on scheduling issues/queue/t ransportation [2 × 3 × 60 minutes]	Students discuss in a group about identifying problems in the surrounding environment related to the Application of Max-Plus algebra on scheduling issues/queue/ transportation formations [2 × 3 × 50 minutes]	● PPT ● I learn (LMS Unand) ●(Specific condition: Zoom meeting, WA group, learning video)	● Study plan and contract ● Problem Identification ● Identify the need for proposed solutions to problems [1], [2] and [3] ●	10%
8	**MID-TERM EXAM**									
9	CLO-4 Students are able to choose	Accuracy in choosing methods, data,	Proposal progress 5%	Students collect data, present data, and		Students discuss in teams to determine		● PPT ● I learn	Methodology to solve the problem	5%

Week	CLO	Indicator	Assessment	Learning material		Learning experience		Method/Platform	References	Weight
	methods, data, data collection techniques, and basic techniques to solve problems related to the Application of Max-Plus algebra on scheduling issues/queue/transportation (ILO-6: PI-1)	data collection techniques, data presentation techniques, and basic techniques for solving problems related to the Application of Max-Plus algebra on scheduling issues/queue/transportation		determine basic techniques to solve problems related to the Application of Max-Plus algebra on scheduling issues/queue/transportation Time allocation [1 x 3 x 50 minutes]		problems and propose solutions Time allocation [1 x 3 x 120 minutes]		(Kondisi tertentu: Zoom meeting, WA group, video pembelajaran)	References [3]	
	CLO-8 Students are able to work in teams (ILO-8)	The ability of students to work in teams	Proposal progress 5%					●		5%
10-11	CLO-5 Students are able to use the concepts of Max-Plus algebra to solve the problems on scheduling issues/queue/transportation (ILO-4: PI-1);	Accuracy in using related theoretical concepts Max-Plus algebra to solve the problems on scheduling issues/queue/transportation accuracy in interpreting calculation results using concepts of Max-Plus algebra to solve the problems on	Project report 5%	Review and discussion of the use of concepts related to the Application of Max-Plus algebra on scheduling issues/queue/transportation [2×3×50 minutes]		Students find references and learn about the concepts related to the topic of the project Time allocation [2×3×60 minutes]	-Students discuss in groups about using the concepts of Max-Plus algebra to solve the problems on scheduling issues/queue/transportation Time allocation [2×3×60 minutes]	Ilearn	concepts of Max-Plus algebra to solve the problems on scheduling issues/queue/transportation	5%

Week	CLO	Indicator	Assessment	Learning		Online activity	Activity	Platform	Material	%
				scheduling issues/queue/transportation						
12-13	CLO-6 Students are able to analyze and evaluate research results (ILO-6: PI-1)	Accuracy in analyzing and evaluating design results	Progress report 5%	Discussion of analysis and evaluation of the final results of the study [2 x 3 x 50 minutes]		Students conduct research final results evaluation activities based on the results of team discussions [2 x 3 x 60 minutes]	Students work in teams to evaluate research results [2 x 3 x 60 minutes]	Ilearn	Stages and Review of the final results of the study	5%
	CLO-8 Students are able to work in teams (ILO-8)	The ability of students to work in teams	Progress report 5%							5%
14-15	CPLO-7 Students are able to communicate the results of their research orally and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3)	Accuracy in communicating the result analysis orally (presentation) and in the form of scientific articles	Presentation project 10%	Kuliah dan diskusi - Penjelasan materi kuliah - penjelasan tugas [2×3×50 minutes]		Presentation project Time allocation [2×3×60 minutes]	Students refine reports based on feedback Time allocation [2×3×60 minutes]	Ilearn, zoom	Presentation project	10%
	CLO-8 Students are able to work in teams (ILO-8)	The ability of students to work in teams	Research report and presentation 5%							5%
16	CLO-5 Students are able to use the concepts of Max-Plus algebra to solve the	Accuracy in using related theoretical concepts Max-Plus algebra to solve the problems on	Research report 5%	Review and discussion of the use of concepts related to the Application of		Students find references and learn about the concepts related to the topic of the project	-Students discuss in groups about using the concepts of Max-Plus	Ilearn	concepts of Max-Plus algebra to solve the problems on scheduling	5%

	problems on scheduling issues/queue/transportation (ILO-4: PI-1);	scheduling issues/queue/transportation accuracy in interpreting calculation results using concepts of Max-Plus algebra to solve the problems on scheduling issues/queue/transportation		Max-Plus algebra on scheduling issues/queue/transportation [1 x 3 x 50 minutes]		Time allocation 1 x (3x60) minutes	algebra to solve the problems on scheduling issues/queue/transportation Time allocation 1 x (3x60) minutes		issues/queue/transportation	
	CLO-6 Students are able to analyze and evaluate research results (ILO-6: PI-1)	Accuracy in analyzing and evaluating design results	Final report 5%	Project Presentation		Students refine reports based on feedback Time allocation 1 x (3x60) minutes	Students refine reports based on feedback Time allocation 1 x (3x60) minutes	Ilearn		5%
	CLO-7 Students are able to communicate the results of their research orally and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3)	Accuracy in communicating analysis results orally (presentation) and in the form of scientific articles	Final report 5%							5%
	CLO-8 Students are able to work in teams (ILO-8)	The ability of students to work in teams	Final report 5%							5%

1 credit = 50 minutes face-to-face meeting, 60 minutes structured study, 60 minutes independent study
Each meeting duration is 3 credits = 3×50 minutes

Indicators, Criteria, and Assessment Weights

1. Assessment weight for each Assessment

NO	Assessment	Weight (%)
1	Mid-term test	20
2	Proposal (progress and report)	20
3	Presentation	10
4	Project (progress, report, article and poster)	50
TOTAL		**100**

2. Assessment weight for Intended Learning Outcome
   - CLO-1: 10 %
   - CLO-2: 10 %
   - CLO-3: 20 %
   - CLO- 4: 20 %
   - CLO-5: 20 %
   - CLO-6: 20%

Assessment Plan Table:

No.	CLO	Assessment				Weight (%)
		Mid-Term Exam	Proposal (progress and report)	Project (progress, report, article and poster)	Presentation	
1	Students are able to explain matrices, modules, and systems of linear equations over algebra max-plus (ILO-5 : PI-1)	10				10
2	Students are able to determining the eigenvalues and vectors of a matrix over a max plus algebra (ILO-5 : PI-1)	10				**10**

No	Description					
3	Students are able to identify real problems related to vector spaces, inner yield spaces, values and eigenvectors, and linear formations (ILO-3: PI-1, PI-2)		10	5		15
4	Students are able to choose methods, data, data collection techniques, and basic techniques to solve problems related to vector spaces, deep yield spaces, values and eigenvectors, and linear formations (ILO-6: PI-1)		5	5		10
5	Students are able to use the concepts of vector space, inner product space, value and eigenvector, and linear transformation to solve real problems (ILO-4: PI-1)			10		10
6	Students are able to analyze and evaluate research results (ILO-6: PI-1)			10		10
7	Students are able to communicate the results of their research orally and in writing according to scientific principles. (ILO-7 : PI-1, PI-2, PI-3);				10	20%
8	Students are able to work in teams (ILO-8)		5	10		15%
	Total	20	**20**	50	10	**100,0 %**

Information:

TK: Group ask

Matrix of CLO and ILO

CLO	ILO																																
	1			2			3			4			5				6					7			8				9			
	PI			PI			PI			PI			PI				PI					PI			PI				PI			
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	4	1	2	3	4	5	1	2	3	1	2	3	4	1	2	3	4
1													□																			
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4																	□															
5										□																						
6																	□															
7																						□	□	□								
8																									□	□	□	□				